# Characteristics and Problems of the Gifted: a neural efficiency model

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**ABSTRACT**. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
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## Introduction

Society has always been fascinated by creative genius, by the great thinkers, scientists, and artists, such as Einstein, Shakespeare or da Vinci, who have laid the foundations for our present knowledge and culture. Genius is generally viewed as very valuable, but rare. Therefore, it is worth investigating how we can optimally exploit this scarce resource, and, if possible, make it more abundant. This means that we must try to understand at the deepest level the characteristics that distinguish an exceptionally creative mind from an ordinary one. Moreover, we should try to understand the processes that produce these characteristics—whether at the biological, psychological, social or cultural level. This will allow us to see how we can foster such processes, and which obstacles we must remove in order to maximally reap the benefits from a gifted mind.

That there are plenty of such obstacles becomes obvious once we note how unevenly distributed genius is: most well-known examples, such as the ones above, are European or American men, from a middle or upper class background. That world-changing creativity requires a minimum level of health, wealth, education and supporting infrastructure seems obvious, explaining why top intellectual achievements are rare in developing countries. However, it is much less obvious why such an exceedingly small number of women have reached the highest levels of eminence. None of the standard tests of intelligence and creativity find significant differences in potential achievement between men and women. The sociological observations of an "old boys networks" or "glass ceiling" in part explain this discrimination, but we would like to move to a deeper, psychological level to understand the mechanisms that hold back women and other classes of gifted people from achieving their full potential. For that we need to better understand what giftedness precisely is.

Until now, we have used the terms "genius", "creativity", "intelligence" and "giftedness" more or less interchangeably. So let us propose more precise definitions. "Genius" typically refers to an exceptional intellectual achievement, such as the Theory of Relativity or the Mona Lisa. As such, it is recognized after the fact, sometimes well after the death of its author. This makes "genius" a far too subjective and unreliable concept to categorize people here and now, and the term has therefore been all but abandoned in the psychological literature. "Creativity", while referring to a more common

type of achievement, suffers to some degree from the same problem: who is to judge which intellectual product is sufficiently novel or important to be deemed "creative"?

"Intelligence" at first sight seems more easy to determine. If we define it as "problem-solving ability", then we can develop an objective measure simply by counting how many problems from a list a certain person can solve. This is the basic idea behind IQ tests: the number of correct answers to a standard questionnaire is normalized so that the average score for the population is 100 and the standard deviation 15. The following labels are generally accepted for the IQ scores that we would associate with the highest levels of achiement: *gifted* - 130 and above, *highly gifted* - 145 and above, *exceptionally gifted* -160 and above. Thus giftedness could be defined quantitatively as ability more than 2 standard deviations above the average, and what used to be called "genius" as 4 or more standard deviations.

But intelligence too is a problematic concept. This is seen nowhere more clearly than in artificial intelligence, the research domain that aims to develop computer programs exhibiting a human-level intelligence. After half a century of failed attempts to achieve this lofty goal, the main lesson learned is that intelligence is highly contextual. First, intelligence requires knowledge, and depending on the kind of knowledge available, problems may be trivial or impossible to solve. Second, intelligence cannot exist purely in an abstract realm of ideas: real-world problem-solving requires interaction (perception and action) with an encompassing environment. Practically, this means that problem-solving ability strongly depends on the available cognitive resources (knowledge, heuristics, experience, specialized processing modules...), physical resources (tools, sensors, effectors, writing, maps, ...) and social resources (other people to consult, organizations to channel and coordinate problem-solving activities...).

IQ tests try to circumvent these requirements by selecting problems that are as general and abstract as possible, requiring not more than pen and paper, and a minimum of knowledge. For example, a classical test type probes the breadth of the subject's vocabulary by asking her to choose the closest synonym from a list for a variety of terms. Since we can assume that any adult, native speaker of a language has had a wide opportunity to encounter various words, this test should make little distinction between specialized forms of expertise. But this still requires an upbringing within a particular language community. More "culture-free" tests, such as Raven's Progressive Matrices, avoid any reference to learned knowledge by aksing subjects to recognize regularities in abstract patterns. But even those assume specialized visual analysis skills, a specific logic about which elements of the pattern form a coherent whole, and familiarity with the idea of taking tests by filling in answers on a questionnaire.

Observations such as these have led to a theory of "multiple intelligences" [Sternberg?], which claims that people have different abilities in different problem domains, such as spatial, verbal, emotional and practical. Recent advances have indeed shown that the brain is a complex organ, with specialized modules for domains such as language or spatial manipulation. Therefore it is to be expected that some of these abilities are more developed in some people than in others. Yet, large scale statistical analysis of all the different intelligence-related tests, from Raven's Matrices to general knowledge, academic achievement and professional skills shows that their results are all correlated. This implies that there is at least one factor they have in common, the so-called *general* or *g-factor* [Jensen].

Surprisingly, this factor appears to have little to do with advanced knowledge-based problem-solving, as it is most strongly correlated with the scores on the simplest possible tests, such as reaction times, which do not require anything that we would conventionally call knowledge or intelligence.

In fact, the more advanced the type of test and the person taking it, the lower the mutual correlations between different tests and test items, making the measurement of IQs above 160 essentially unreliable [Jensen]. This can be understood by the fact that ordinary tests are standardized on large populations by eliminating all items that do not correlate well with the overall results because they require too specific skills. In the highest IQ ranges, though, the available population is far too small to achieve reliable standardization, and for the "difficult" problems used to differentiate the most advanced subjects there may not be any generally accepted way of attaining the solution. The true creativity that we could expect in this range may show itself precisely in the fact that different people see problems and their solutions differently (and differently from the experimenter who designed the questionnaire!).

In conclusion, high scores on an IQ test merely give a strong indication of giftedness, but certainly do not define—and even less explain—the trait. The famous longitudinal study of Terman [] followed an extended group of individuals with IQs over 140 from their teens until their nineties. Only a fraction of those achieved the eminence that could be expected from their apparent level of intelligence. This could mean that IQ tests are not a reliable measure of high-level giftedness, or that society throws up too many obstacles for gifted people to achieve their full potential. Most likely, both explanations apply to some extent. On the other hand, the fact that a disproportionately high section of Terman's group did achieve eminence, while hardly any of the not-selected did, indicates that a minimally high IQ of about 140 seems like a necessary, albeit not sufficient, condition for exceptional achievement [Jensen].

This brings us back to the definition of what constitutes giftedness. To avoid the need for after-the-fact assessment of achievement, we will define it as *potential for exceptional achievement*. This potential will be realized only if the environment provides sufficient support. To recognize this potential, we must go beyond IQ tests, and look at a variety of personality traits that include not only problem-solving and cognition, but perception, emotion, motivation, and social relations. As we will see in the next section, giftedness is typically accompanied by a specific complex of such traits. Thus, a simple questionnaire probing into feelings, sensitivities, interests, sense of humor, and relations with peers and authorities can already provide a reliable indication that an individual is gifted, and likely to score high on an IQ test [Silverman]. To understand giftedness, we need to analyse this whole complex of interrelated traits, and not just the problem-solving or creative abilities.

The present paper proposes a simple model to explain these traits and their relations. First, we will review and illustrate the basic traits defining the "giftedness syndrome". After reviewing the literature on the physiological basis of the g-factor, we will propose a hypothesis of neural efficiency that will help us to understand the cognitive, perceptual and emotional traits. We will then use Cszikszentmihalyi's theory of "flow" to infer the individual and social motives that drive gifted individuals. Finally, this theory will help us to understand the often difficult relations

that gifted individuals—and gifted women in particular—have with "normal" people, and how this may prevent their potential from being realized.

## 2. Basic traits

Several studies have compiled lists of traits or characteristics that, in addition to high IQ, distinguish gifted individuals [see e.g.]. An Internet research allowed us to collect more than twenty such lists, which we have compiled further by putting similar traits together in a category, and then selecting the categories that have entries from at least two independent lists. We will now summarize these traits, not piecemeal as most lists do, but proposing a coherent overview of the whole personality, starting with cognition, moving to perception, emotion, motivation and finally social behavior.

### *2.1. Cognition*

As already implied by high IQ results, gifted people excel at reasoning and problem-solving. But they show more than a propensity at tackling puzzles: they are able to generalize from specific cases, seeing the deeper pattern that connects seemingly unrelated phenomena. They quickly grasp complex and abstract concepts, such as in mathematics or science, and their general comprehension is far advanced. Their own thinking is deep, broad and at a high level of abstraction.

Yet, they do more than reason abstractly and logically: they have a very vivid and rich imagination. Together with their capacity to connect and integrate, this gives them a remarkable creativity. Perhaps most noticeable is their constant production of original, unusual ideas, coming up with things that other people would never have thought of, or seen the relevance of. Their mind seems constantly busy, moving very quickly, and often on multiple tracks at the same time.

Not just their thinking, but their learning seems to run in a higher gear. They quickly and eagerly assimilate new knowledge, and they have an excellent memory for the things they have learned. This is perhaps most noticeable in their extensive vocabulary and facility with words and language in general.

### *2.2. Perception/emotion*

Gifted people are very perceptive, showing an excellent sense of observation. They notice things that others are not aware of, and their overall perception of the world seems quite different, in the sense of richness and detail, from the one of ordinary people. Thus what someone else may see as just a chair or a stone, a gifted person may see as a subtle play of light, texture and perspective, the way a professional artist may have been trained to perceive it. They are often sensitive to small changes in the environment, such as temperature differences, or an itchy label in the collar of a shirt.

This high sensitivity is not just sensory but affective: gifted people tend to undergo intense feelings and experiences, that may be elicited by situations to which others hardly react. This brings us to a peculiar weakness or vulnerability typical of many gifted people which Dabrowski [] called "overexcitabilities". This may be viewed as an excessive response to stimuli,

and may occur in different domains: psychomotor, sensual, emotional, imaginational, and intellectual. GPs in general can become easily excited or passionate about an idea, a feeling or something they imagine.

Their rich sense of observation and multitasking mind allow them to see simultaneously many sides to any situation, and consider problems from different viewpoints. In general, we may say that they have a high tolerance for ambiguity and complexity, i.e. they feel little need to reduce their perception to a simple black-or-white categorization. Their ease with ambiguity and paradox also shows in their excellent, but unusual sense of humor, in which they often relativize a situation by looking at it from an unorthodox angle.

### *2.3. Motivation/drive*

Together with strong passions, GPs also have a high drive and great deal of energy. This shows itself in their capacity to sustain their concentration on the topics that interest them. Once they get interested, they can be very persistent and have a long attention span. The downside is that they can sometimes work themselves to exhaustion. Their high level of activity may make it difficult to relax, as they cannot stop thinking.

Whatever their specific interests, they are all driven by intense curiosity, by an overwhelming desire to know and understand. From an early age they are typically avid readers, who will absorb information of all kinds. They have a very broad range of interests, but may be overwhelmed by the diversity, not knowing what to investigate first. As such they may seem to lack focus, apparently getting bored as soon as they have a rough understanding of a domain, and moving on to the next one. Yet, at a deeper level, they continue looking for connecting patterns, for meaning and understanding. Thus, they are seekers for ultimate truths, for the meaning of life.

A GP typically develops a far and wide vision of how things might be or ought to be, and a sense of destiny or mission, as the one who is to realize these visions. The goals they set for themselves are typically very ambitious, and may look unrealistic or unattainable to others. They enjoy difficult challenges, and have a penchant for taking risks, that is, explore situations where the outcome is everything but predictable. This may get them in serious troubles of a kind that other people find difficult to imagine. Another downside of their ambition is that they can be too perfectionistic, setting such high standards for themselves and others that they are in practice disappointed. The fear of failing to achieve the standards they have set for themselves may also keep them from finishing a concrete piece of work, such as writing a book or thesis, as their preparation for it never really seems good enough.

### *2.4. Social relations*

Their intrinsic motivation makes them less dependent on rewards and punishments, praise and criticism given by others. This characteristic of being driven by their own goals rather than by those imposed by society is called “entelechy”. It makes them very independent or autonomous. It also makes them question rules and authorities; they are especially prone to find the gaps and inconsistencies in the conventional view. They often ask embarassing questions, to which people do not know what to answer. They love ardent discussion and the play of question and answer, argument and

counterargument. They are generally non-conformist, preferring to reach their own understanding of an issue rather than to accept the view of the majority or of a higher authority such as church, government, or intellectual establishment.

The downside of this non-conformism is alienation. Gifted people usually feel different, and out of step with the rest of society. Other people find it difficult to understand them, and generally do not appreciate their intensity, perfectionism, questioning, and being "too smart". As a result, GPs have a sense of being alone in the world. Yet, they do not try to compensate for their intrinsic loneliness by desperately seeking company. They rather have a need for solitude, and for periods of contemplation in which they are not disturbed by others. As such, most GPs are categorized as introverted.

The above may have suggested a picture of rather egocentric individuals who do not care much about others. However, the opposite is true: GPs tend to be very compassionate and have great empathy for other people. They can feel along with others, and help them understand themselves in the process. They have a strong sense of fairness, and clear moral convictions. They tend to be outraged at injustice, and try to work for a better society. They strongly value integrity and honesty.

### *Conclusion*

Giftedness is characterized by a complex of traits extending far beyond aptitude for IQ tests. A summary of these traits can be found in Kregerman's [] Characteristics of Giftedness scale, which has been proven to reliably distinguish gifted from non-gifted children (see Table 1).

Most of these traits clearly support the potential for exceptional achievement. For example, to succeed in difficult enterprises you need ambition, passion and perseverance; you need to be able to imagine or envision things beyond the ordinary; you need to be sufficiently independent to overcome skepticism and resistance; you need to be able to see how different elements fit together to form a novel whole.

Yet, giftedness is more than the sum of traits necessary to succeed: it is a coherent "gestalt", or personality type, including traits that appear indifferent or even detrimental to the chances for success. For example, while intellectual non-conformism may be necessary for true innovation, social non-conformism may make it more difficult, as you always need the help of others to succeed. Sensitivity, overexcitatibility and isolation make the gifted more vulnerable, while their compassion and sense of humor seems at best irrelevant to exceptional achievement (one might rather assume that selfishness and seriousness would make it easier to achieve one's ambitions).

We will now argue that all these traits can be inferred from a single underlying characteristic, which we have called "neural efficiency", thus providing a simple and coherent explanation for the gestalt.

Characteristics of Giftedness Scale

1. Good problem solving/reasoning abilities
2. Rapid learning ability
3. Extensive vocabulary
4. Excellent memory
5. Long attention span
6. Personal sensitivity

7. Compassion for others
8. Perfectionism
9. Intensity
10. Moral sensitivity
11. Unusual curiosity
12. Perseverant when interested
13. High degree of energy
14. Preference for older companions
15. Wide range of interests
16. Great sense of humor
17. Early or avid reading ability
18. Concerned with justice, fairness
19. At times, judgment seems mature for age
20. Keen powers of observation
21. Vivid imagination
22. High degree of creativity
23. Tends to question authority
24. Shows ability with numbers
25. Good at jigsaw puzzles

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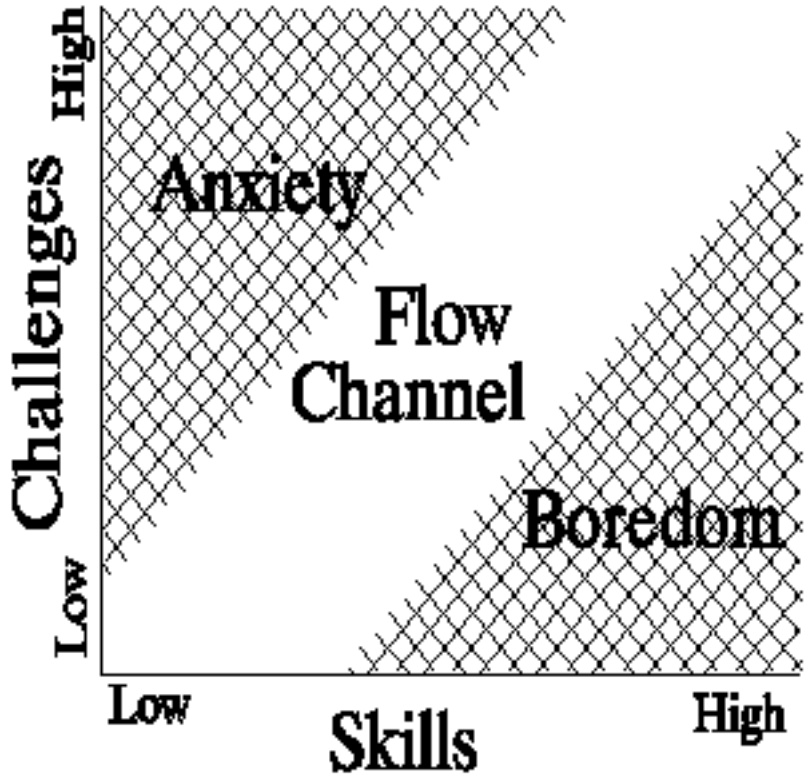
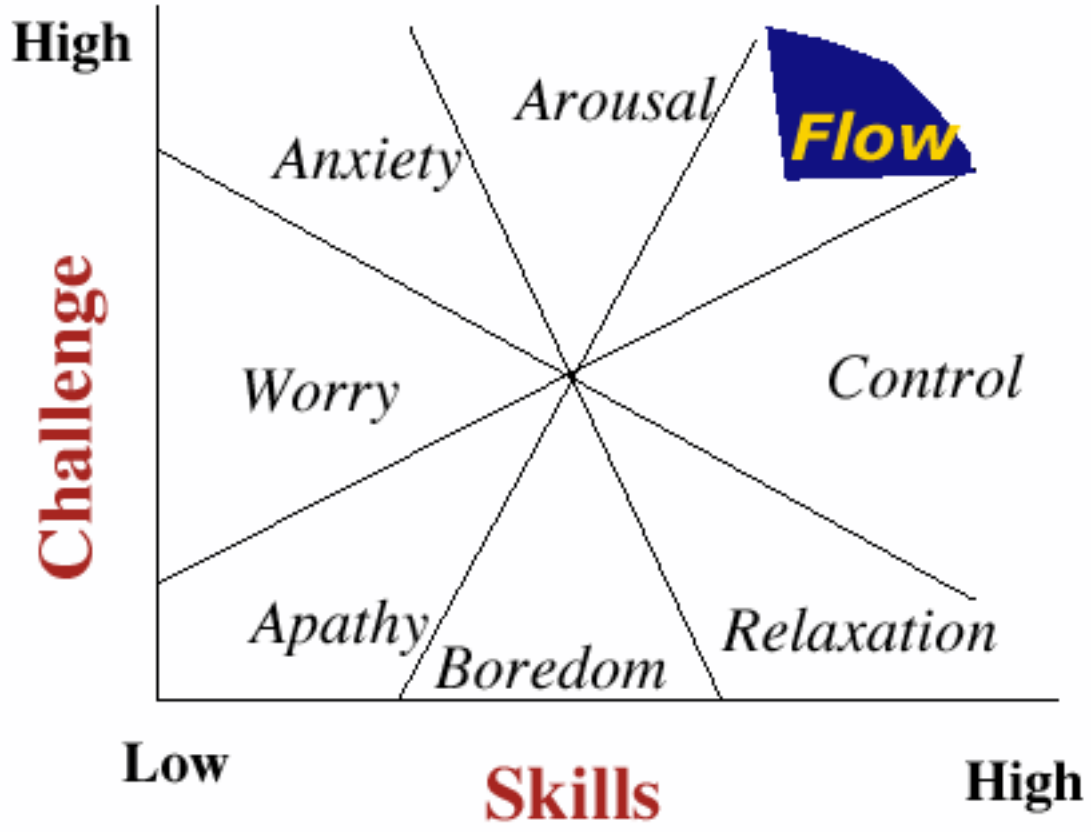
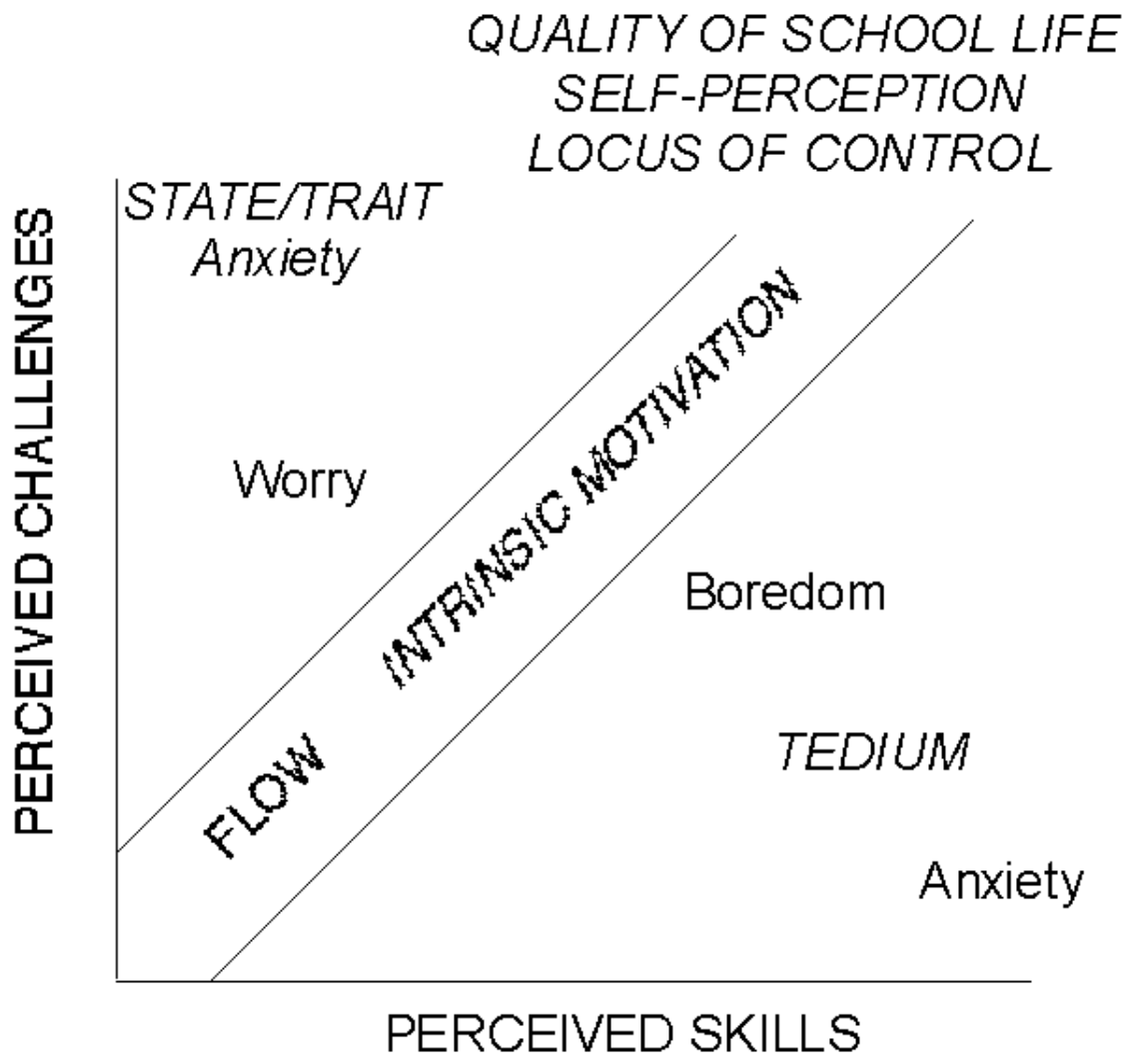



"8-channel model"

**Figure 1**. The expanded 'flow' state model, adapted from Csikszentmihalyi (1975). The variables measured in this study are in italics.




## References


Csikszentmihalyi, M. & Nakamura, J. (2002). The concept of flow. In Snyder, C. R., & Lopez, S. J. (Eds.). The handbook of positive psychology (pp 89 – 105). New York: Oxford University Press

M. Csikszentmihalyi & I. Csikszentmihalyi, Optimal Experience: Psychological studies of flow in consciousness (pp. 92 – 117). New York: Cambridge University Press.

Terman, L. M., & Oden, M. H. (1929-). Genetic studies of genius: Vol. 1-6. Stanford, CA: Stanford University Press.

VanTassel-Baska, J. (1998). Excellence in educating gifted and talented learners. Denver, CO: Love Publishing Company.


[8778,3]
ti: Psychology and education of the gifted
au: Walter B. Barbe
au: Joseph S. Renzulli
im: Irvington : New York, 1975
co: 481 p.

is: ISBN 0470047755
pk: VUB: CB 159.920.2 G BARB 75

[66548,3]
ti: The intellectually gifted: an overview
au: Wayne Dennis
im: Grune and Stratton : London, 1976
co: 336 p.
is: ISBN 0808909622
pk: VUB: CB 372.6 G DENN 76

[112714,3]
ti: Characteristics and identification of gifted and talented students
au: Frederick B. Tuttle [Jr.]
au: Laurence A. Becker
im: National Education Association : Washington, 1980
co: 143 p.
is: ISBN 0810607328
pk: VUB: CB 372.6 G TUTT 80

[168906,3]
ti: Gifted, talented, and creative young people: a guide to theory, teaching, and research
au: Morris I. Stein
im: Garland : New York, 1986
co: 465 p.
re: Garland reference library of social science; 120
is: ISBN 0-8240-9392-5
pk: VUB: CB 159.920.1 G STEI 86

[319277,3]
ti: A theory of conceptual intelligence: thinking, learning, creativity and giftedness
au: Li Rex
im: Praeger : Westport (Conn.), 1996
co: 236 p.
is: ISBN 0-275-95326-2
pk: VUB: CB 159.960.2 G LI 96

[333444,3]
ti: Gifted grownups: the mixed blessings of extraordinary potential
au: Marylou Kelly Streznewski
im: Wiley : New York (N.Y.), 1999
co: 292 p.
is: ISBN 0-471-29580-9
pk: VUB: BSVB -
pk: VUB: CB 159.920 G STRE 99

[338792,3]
ti: Talent in context: historical and social perspectives on giftedness

au: Reva C. Friedman
au: Karen B. Rogers
im: American Psychological Association : Washington (D.C.), 1998
co: 218 p.
is: ISBN 1-55798-493-X
pk: VUB: CB 159.920.1 G FRIE 98

Dabrowski, K. (1964). Positive disintegration. London: Little, Brown & Co. (Out of print).

Dabrowski, K. (1972). Psychoneurosis is not an illness. London: Gryf. (Out of print)

Dabrowski, K & Piechowski, M.M. (1977) Theory of levels of emotional development (Vols. 1 & 2). Oceanside, NY: Dabor Science. (Out of print)

## Overexcitability and the highly gifted child

### Author(s)

Lind, S.

### Attributes

Parenting Strategies, Social Emotional

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### Description

In this full text article Sharon Lind explains how the concept of overexcitability, from the work of Kazimierz Dabrowski, relates to some highly gifted individuals. The article also recommends strategies for dealing with highly gifted individuals who have extremely high levels of sensitivity to the world around them.